Sulfate resistance of plain and blended cements exposed to varying concentrations of sodium sulfate

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Abstract: Concrete deterioration due to sulfate attack is the second major durability problem, after reinforcement corrosion. This type of deterioration is noted in the structures exposed to sulfate-bearing soils and groundwater. Though concrete deterioration due to sulfate attack is reported from many countries, the mechanisms of sulfate attack have not been thoroughly investigated, particularly the effect of sulfate concentration and the cation type associated with the sulfate ions on concrete deterioration. This study was conducted to evaluate the performance of plain and blended cements exposed to varying concentrations of sodium sulfate for up to 24 months. Four types of cements, namely Type I, Type V, Type I plus silica fume and Type I plus fly ash, were exposed to five sodium sulfate solutions with sulfate concentrations of 1%, 1.5%, 2%, 2.5% and 4%. These concentrations are representative of the sulfate concentration in highly saline soils. The sulfate resistance was evaluated by visual examination and measuring the and reduction in compressive strength. The maximum deterioration, due to sulfate attack, was noted in Type I cement followed by silica fume and Type V cements. The performance of Type V, Type I plus silica fume and Type I plus fly ash was not significantly different from each other. The enhanced sulfate resistance noted in the Type I cement blended with either silica fume or fly ash indicates the usefulness of these cements in both sulfate and sulfate plus chloride environments.